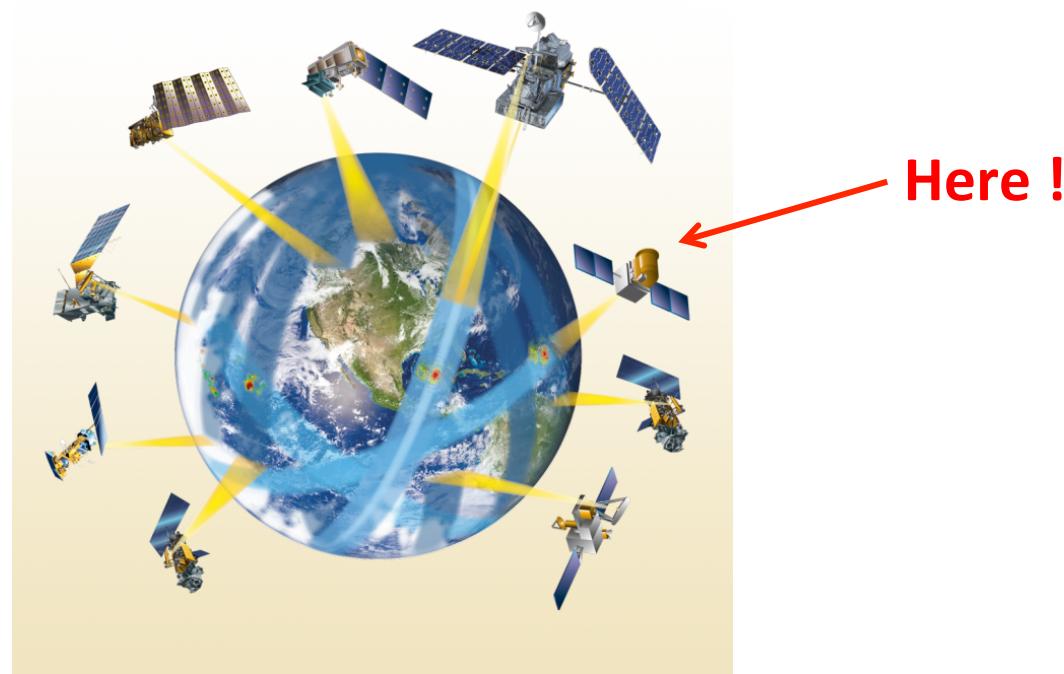


The Megha-Tropiques Mission: Status after almost **4 Years** in orbit



Rémy Roca (CNRS)
OMP/LEGOS, Toulouse, France
and the french Megha-Tropiques Science Team



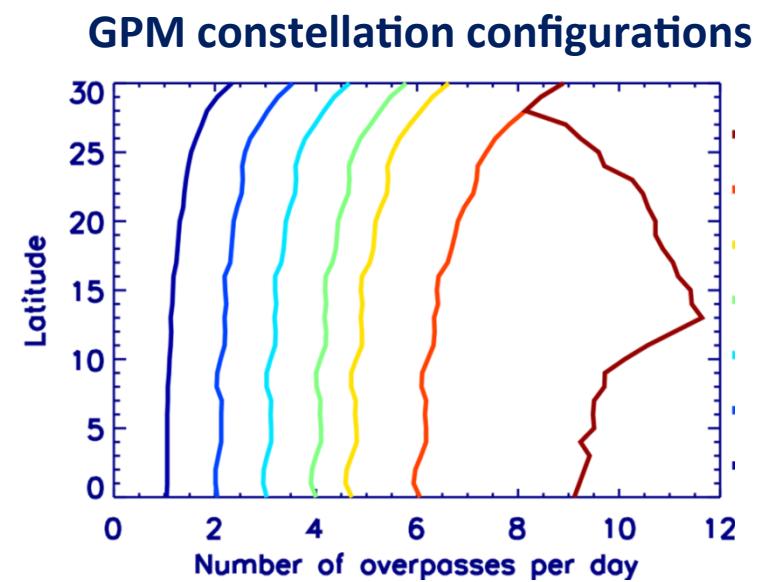
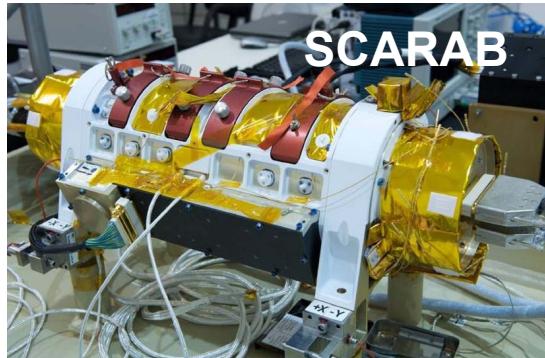
Outline of the presentation

- 1. Status of the Mission**
- 2. Impact of Megha-Tropiques on constellation rainfall estimates**
- 3. Some hydrology oriented applications**
- 4. Summary**

The status of the Megha-Tropiques mission

The mission

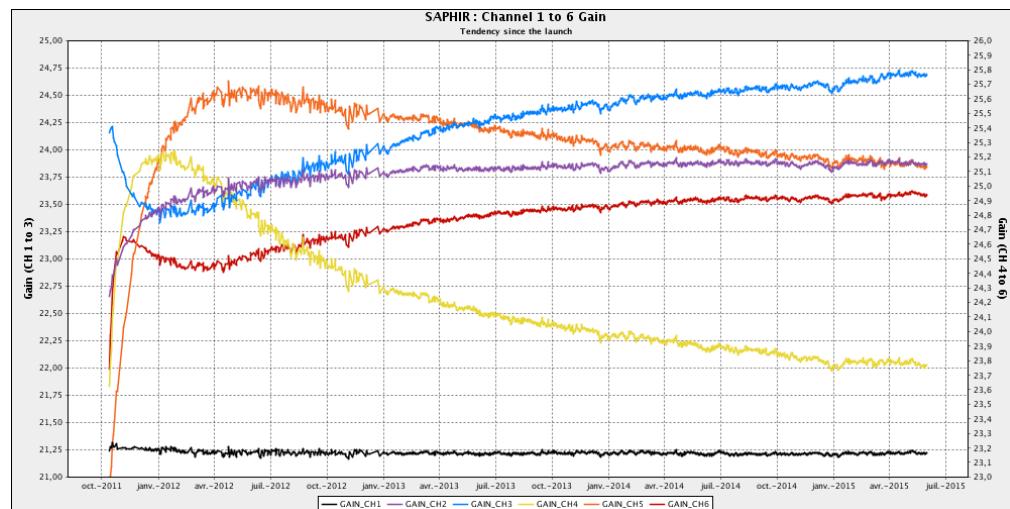
- Indo-French Mission built by ISRO and CNES launched in October 2011
- dedicated to the monitoring of the water and energy cycle in the tropics
- Orbit with 20° inclinaison on the equator
- Nominal life: 3 years + 2 years extension
- End of 2016 Senior Review for further extension



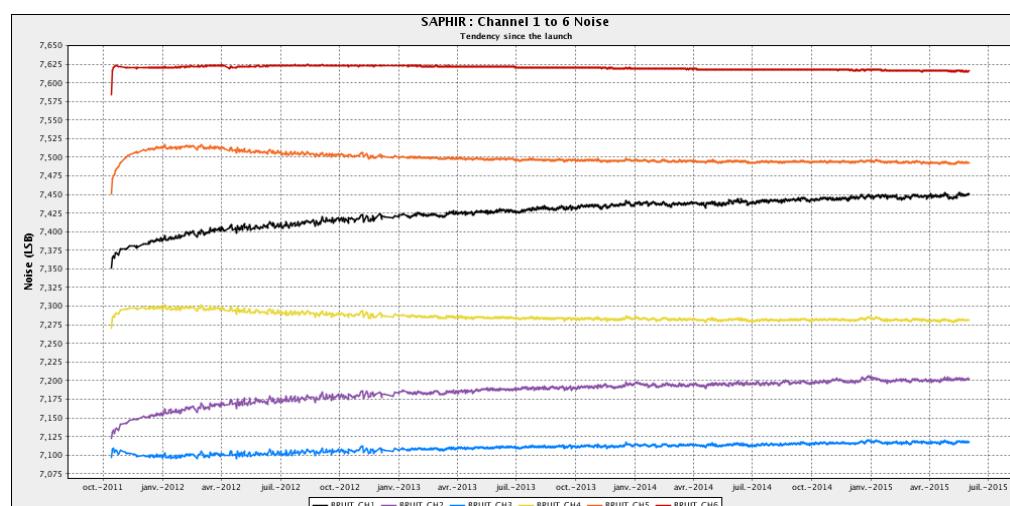
Courtesy CNES

The status of the Megha-Tropiques mission

The SAPHIR instrument (1/2)



- SAPHIR fully operational after more than 1300 day (close to 4 years).
- Instrument in perfect health, no drift, no attrition, the mechanism have reached more than **76 millions** rotations.
- About 150 parameters are daily controlled with no warning until now.
- The instrument was stopped for about 48h after a corruption of the RAM by SEU (Single Event Upset) and restart with no drift compare to before the shutdown.
- The NRT distribution is operational for more than 1 year
- The community of users is growing and there are welcome.

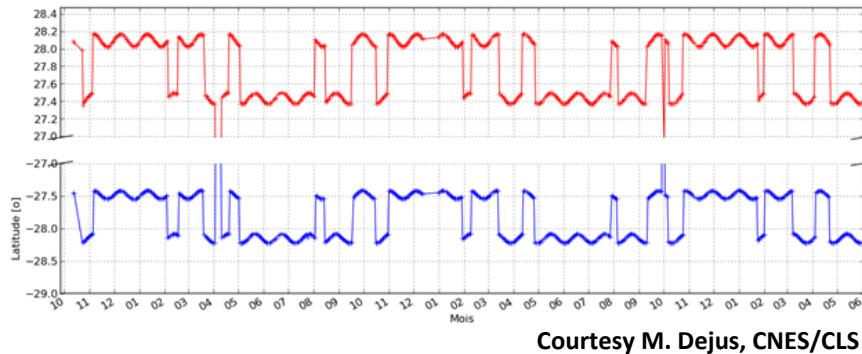


Courtesy M. Dejus , CNES

The status of the Megha-Tropiques mission

The SAPHIR instrument (2/2)

Goddard alerted us of a SAPHIR scan asymmetry....



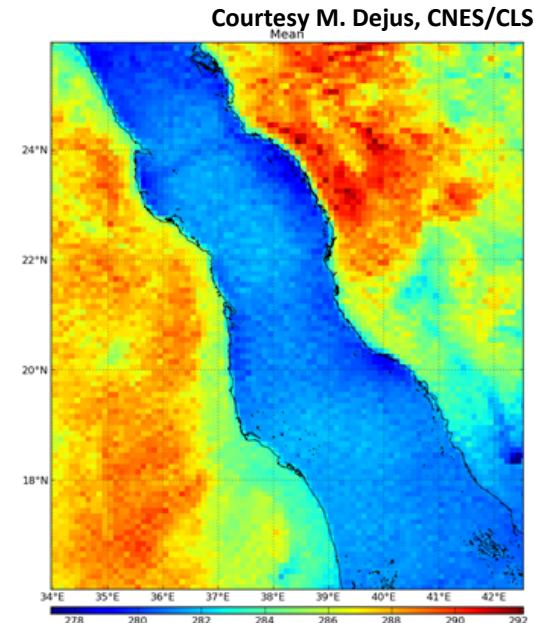
- Very weak random variation ($\sim 0.01^\circ$)
-Confirmed by the instrument commissioning
- Sinusoïdal 33 days variation ($\sim 0.2^\circ$)
-Orbit not perfectly circular $e=0.00102$
- Depending on the orientation of the satellite

Thanks to Michel Capderou

The most compelling explanation lies in the stator/rotor angle compensation under further investigation at CNES

The nadir is not the central pixel of the scan line currently shift estimated at ~ 1 pixel / 0.1° on earth

Similar issues with SCARAB.

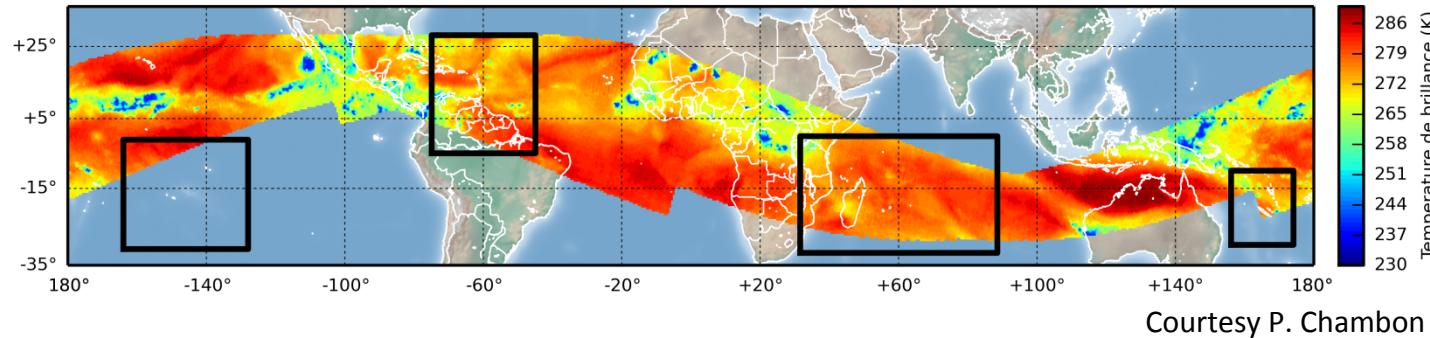


Note that the individual pixels are very well geolocated

Real time stream of SAPHIR at NWP

Clear sky radiance

04/09/2014 0-6Z Canal 183.31 +/-6.8 GHz



- **Operational Assimilation**
 - Météo-France since 13 April 2015
 - Global model ARPEGE
 - Regional model ALADIN Réunion
 - JMA since 25 June 2015
 - Global Model
 - NCMRWF since March 2014
 - GFS model
 - SAC Ahmedabad
 - WRF based forecast system

**NRT Stream via EUMETCast
since Summer 2014**

- **Testing on going**
 - NOAA see [Ralph Ferraro's presentation](#)
 - Météo-France for total sky radiance
 - UK MET Office
- **Discussed**
 - ECMWF total sky radiance (either ope or for reanalysis) joint effort with Météo-France (late 2015)

Outline of the presentation

1. Status of the Mission
2. **Impact of Megha-Tropiques on constellation rainfall estimates**
3. Some hydrology oriented applications
4. Summary

The impact of the Megha-Tropiques mission on rainfall estimation

The case for the TAPEER product

Tropical Amount of Precipitation with Estimation of ERrors

Accumulated Rainfall (in mm) = \bar{R}_{cond} (in mm/day) x Fraction (in %)

STEP1: Constellation for \bar{R}_{cond}

BRAIN Estimation on TMI, AMSR2, SSMI F15, SSMIS F16,F17,F18

5° x 5 days optimized for estimating the mean with as many point as possible

STEP2: Constellation for Frac

BRAIN Detection on TMI, AMSR2, SSMI F15, SSMIS F16,F17,F18

Hong detection on SAPHIR

3°x 1 day optimized for representativity of the BTIR threshold with daily update

BIAS correction scheme: based on the TRMM PR v7 large scale statistics

NEW!

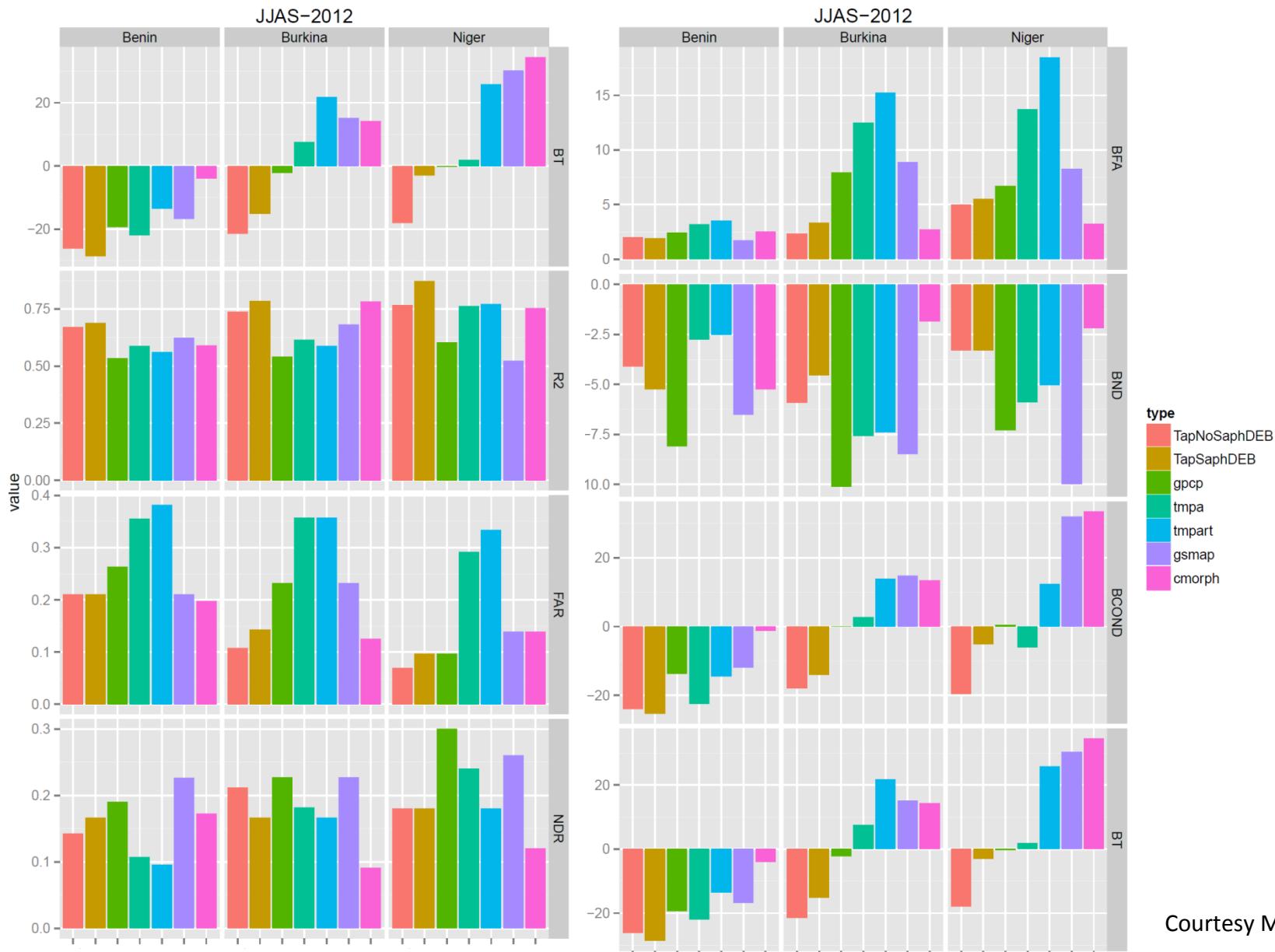
Preliminary release of JJAS 2012,2013 and 2014 available since March 2015

<ftp://climserv.ipsl.polytechnique.fr/Megha-Tropiques/TAPEER/>

Expected full release since launch and streaming (48h delay) at fall 2015

The impact of the Megha-Tropiques mission on rainfall estimation

Comparison to rain gauges network at 1° daily resolution

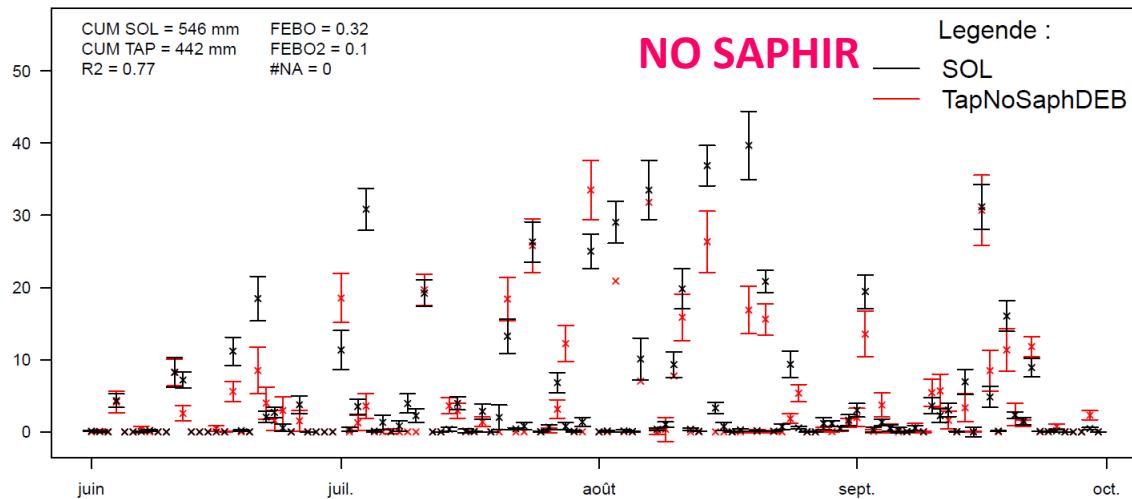


Courtesy M. Alcoba

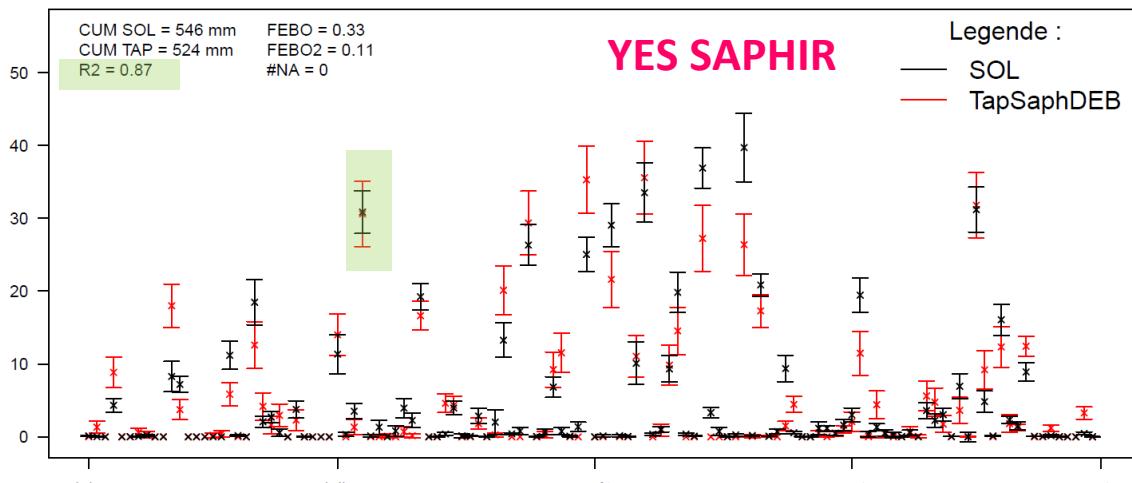
The impact of the Megha-Tropiques mission on rainfall estimation

The case for the TAPEER product

Niger 2012



Niger



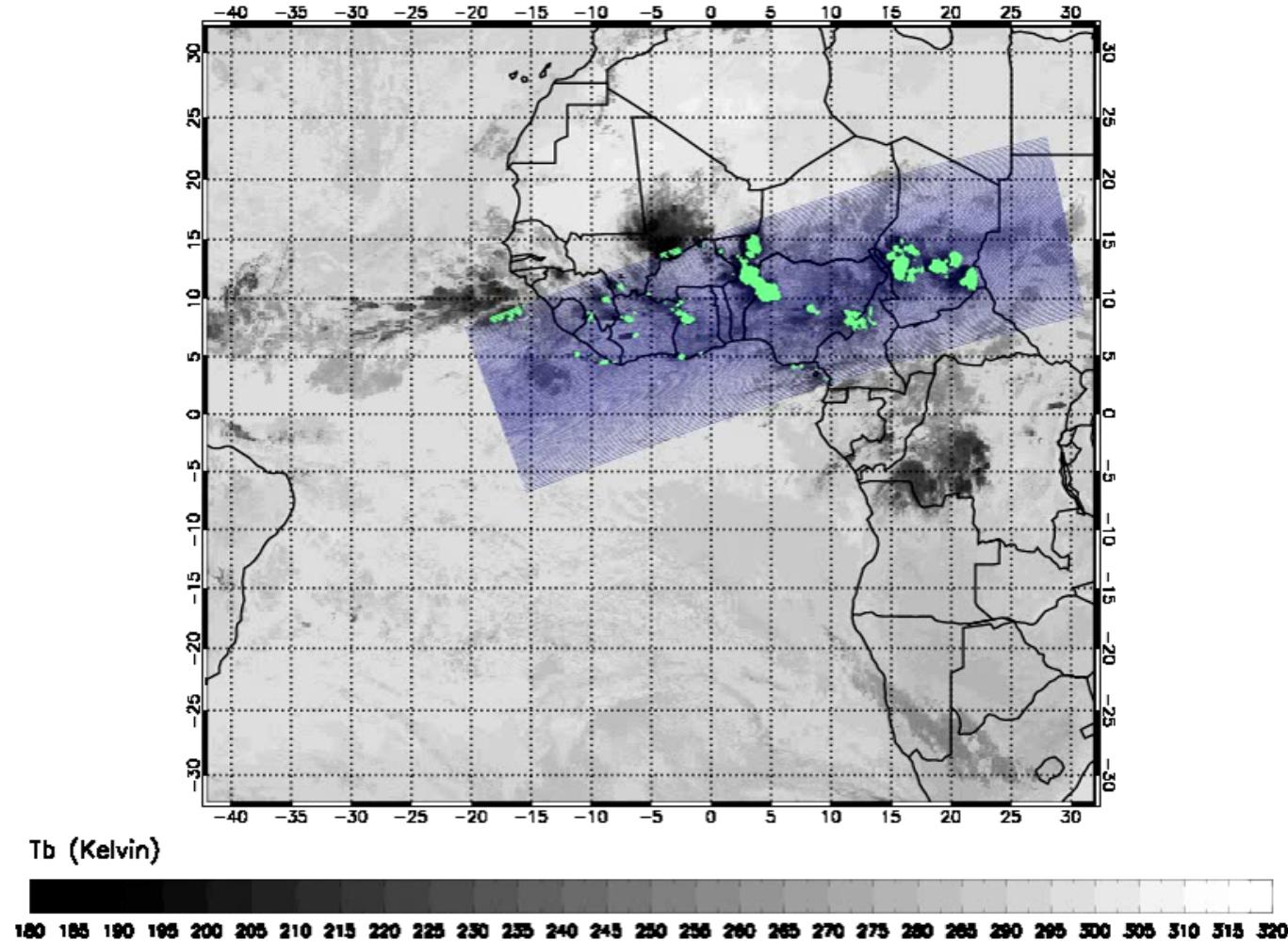
Case study of the 4th of July 2012

Courtesy M. Alcoba

The impact of the Megha-Tropiques mission on rainfall estimation

The case study of the 4th of July 2012

2012-07-04 00H00



Courtesy N. Taburet

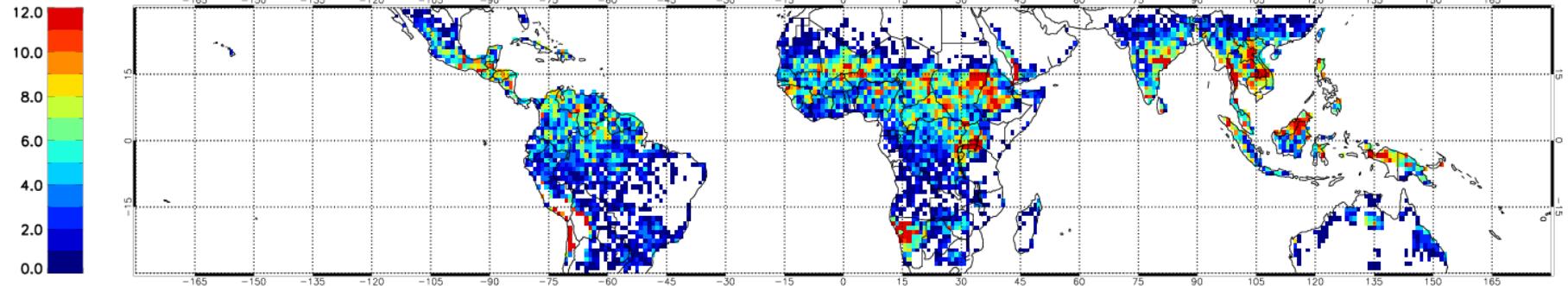
The impact of the Megha-Tropiques mission on rainfall estimation

Maps of occurrence of the « 4th of July » effect

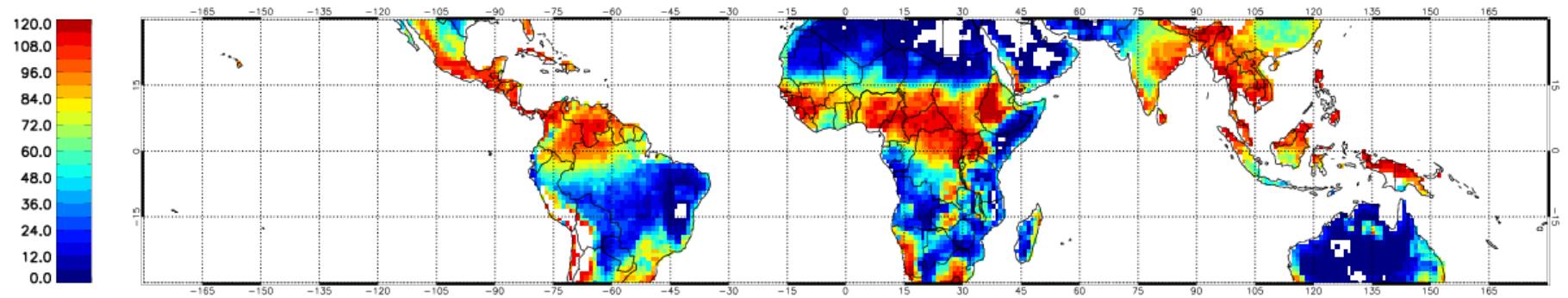
JJAS 2012

SAPHIR vs No SAPHIR

Nb days difference > 50 %



nb detection



Courtesy N. Taburet

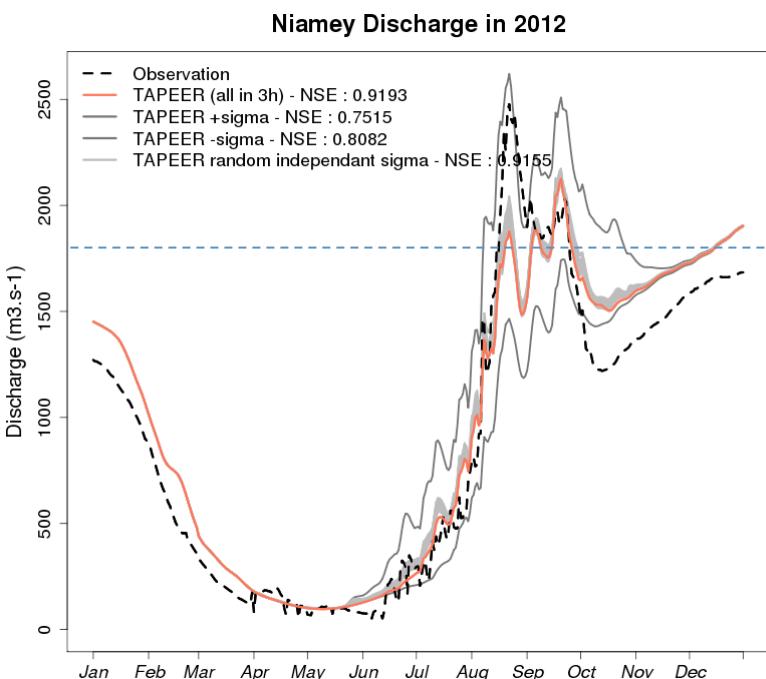
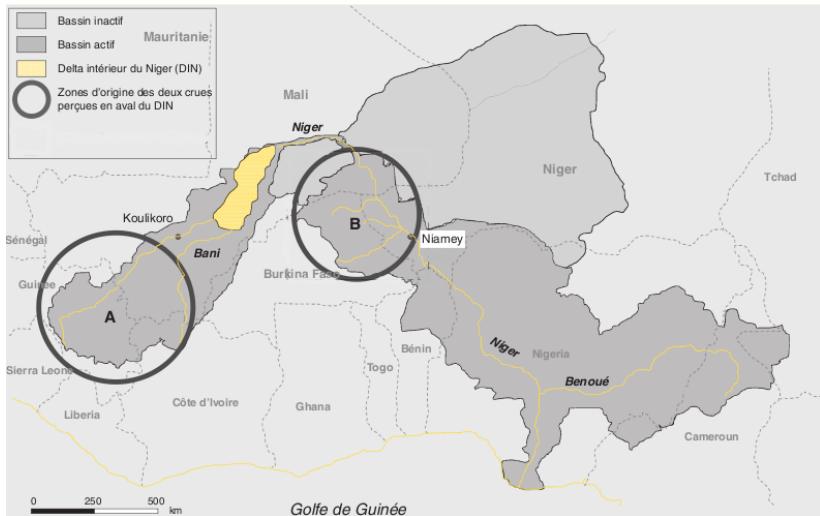
Outline of the presentation

1. Status of the Mission
2. Impact of Megha-Tropiques on constellation rainfall estimates
- 3. Some hydrology oriented applications**
4. Summary

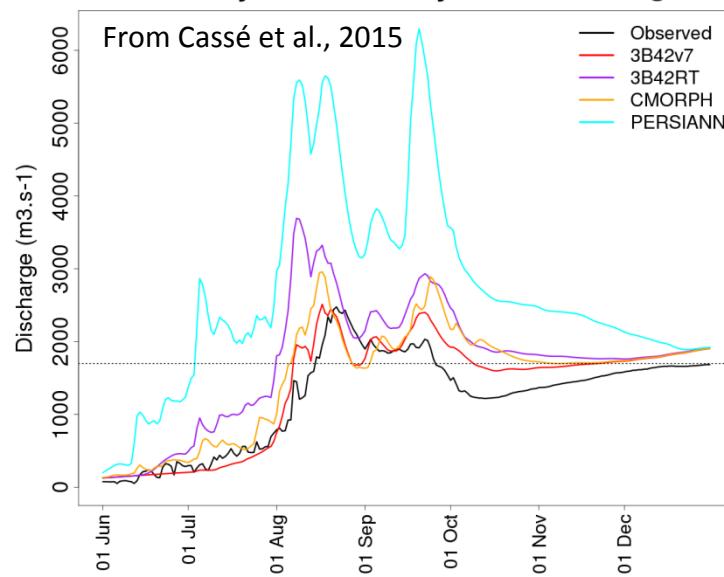
Hydrological applications of TAPEER

Flooding at Niamey

Courtesy of Marielle Gosset



Niamey 2012 3 hourly rainfall forcing

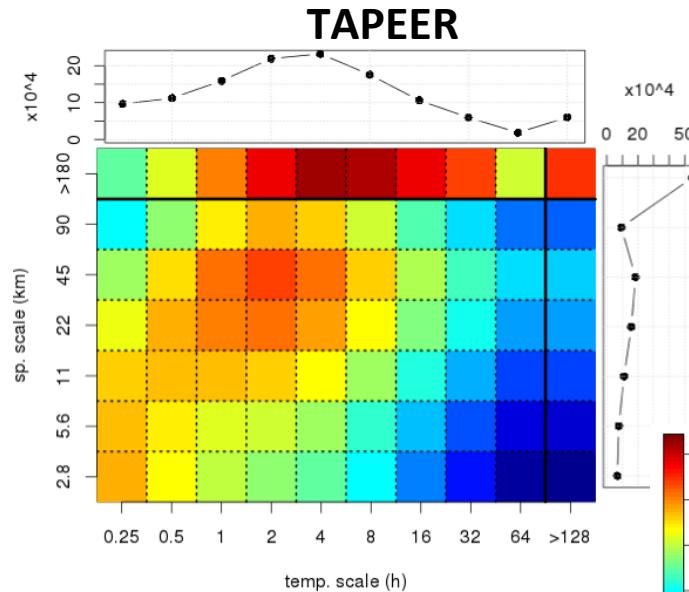


Towards the monitoring of tropical rivers using
GPM constellation rainfall and uncertainty
estimates together with river flow products from
future mission SWOT

Hydrological applications of TAPEER

Downscaling the TAPEER product rain mask

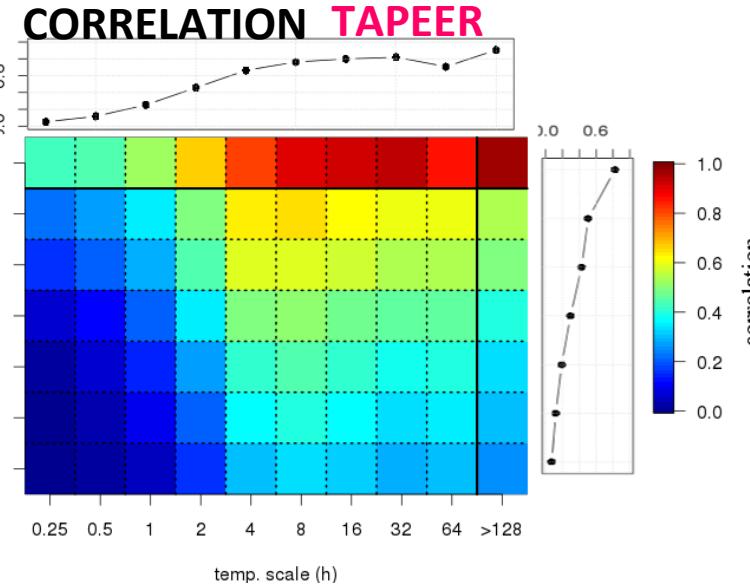
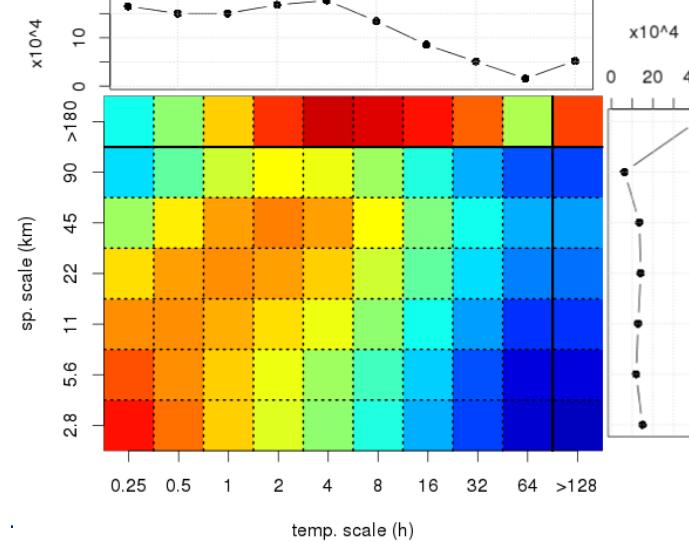
From Guilloteau et al., 2015 to be submitted to JHM



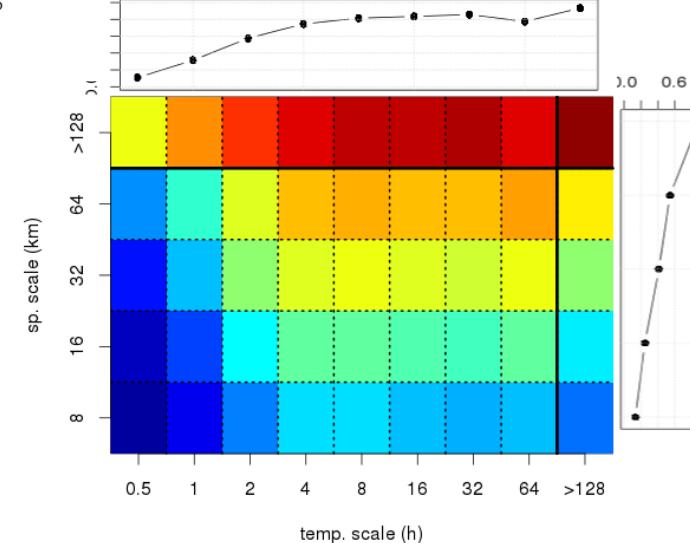
Summer 2012

Ouagadougou

GROUND RADAR



CORRELATION CMORPH



Weaker performance
TAPEER < 4h
< 20km
CMORPH < 2h
< 32km

Outline of the presentation

- 1. Status of the Mission**
- 2. Impact of Megha-Tropiques on constellation rainfall estimates**
- 3. Some hydrology oriented applications**
- 4. Summary**

Summary

Mission is reaching the 4th year of operation

SAPHIR is in perfect health

Data are available in NRT via EUMETCast since summer 2014

Leading centers are already or plan to assimilating the SAPHIR data

Mid-2016 Senior Review to extend the mission for two more years

A review paper is published Roca et al., 2015 , Frontiers in Atmospheric Sciences

Rainfall product at 1°/1day with uncertainty estimates has been finalized.

Preliminary release of summer 2012, 2013 and 2014 available since March 2015

<ftp://climserv.ipsl.polytechnique.fr/Megha-Tropiques/TAPEER/>

Production in operational mode expected in Fall 2015

Megha-Tropiques/SAPHIR improves the score of our product in West Africa

Captures an intense event over Niamey otherwise missed

First applications directed towards **tropical hydrology** are emerging

Connection with the SWOT activity

Getting ready for the conference « Water and Energy cycle in the Tropics »

In Paris 17-19 November 2015 ! More information on the Megha-Tropiques site

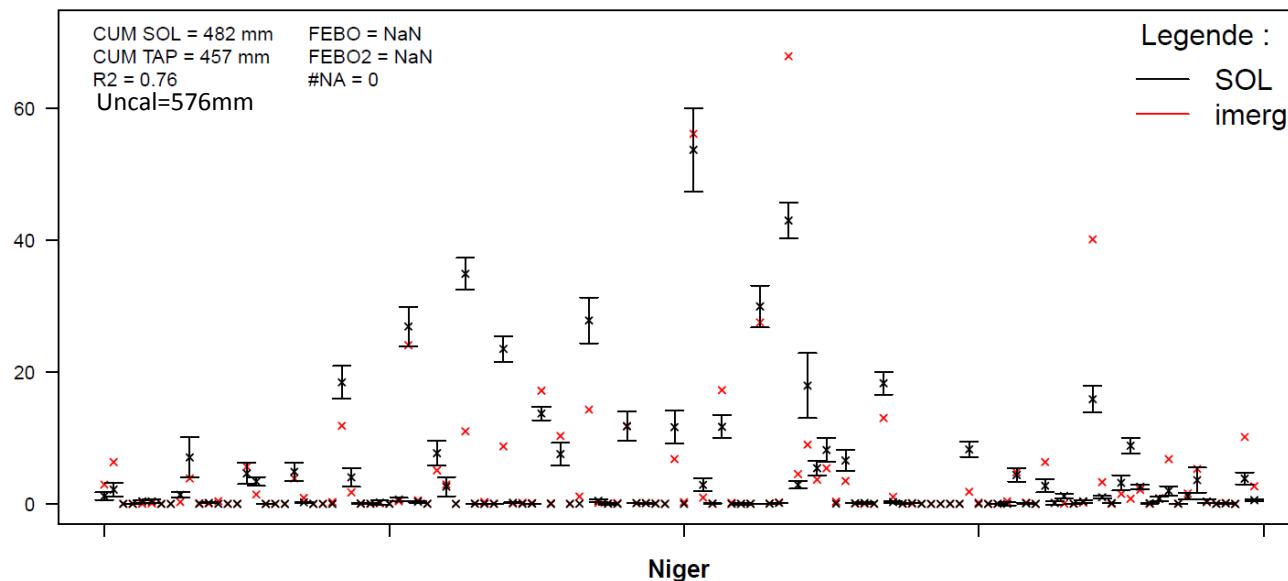
Comparing with other products

Over West Africa,

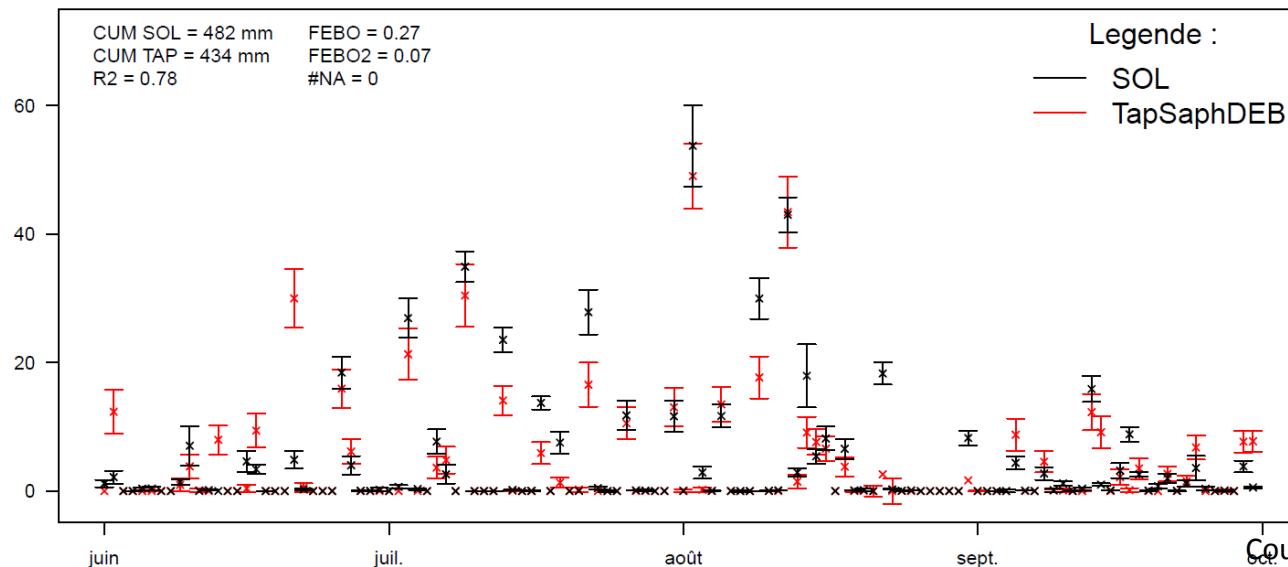
Gosset et al., 2015 to be submitted

Niger

Summer 2014



Niger

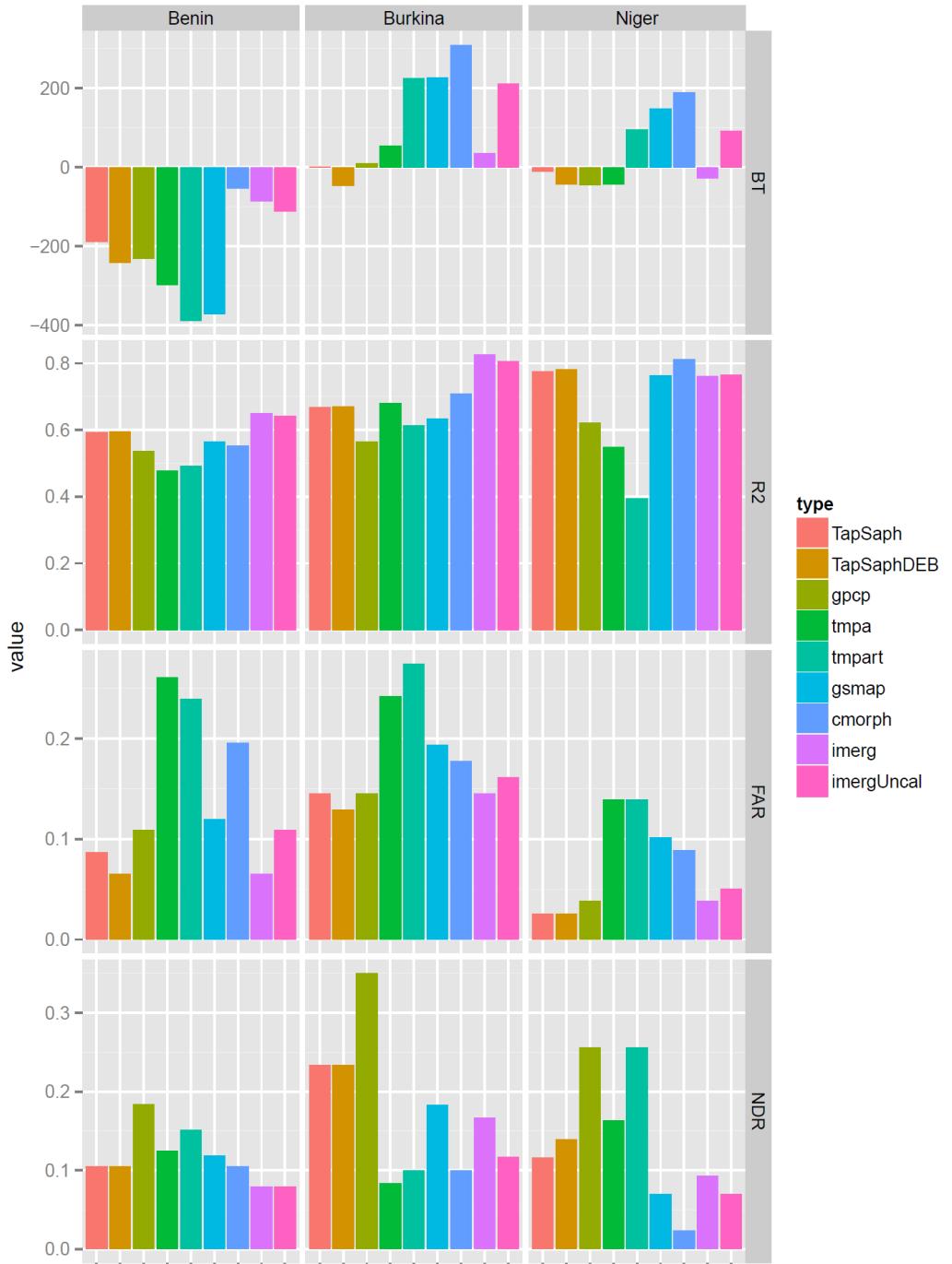


Courtesy M. Alcoba

Comparing with other products

Over West Africa,

Gosset et al., 2015 to be submitted



Courtesy M. Alcoba

